A Seamless Development Ecosystem for Neurosynaptic Applications

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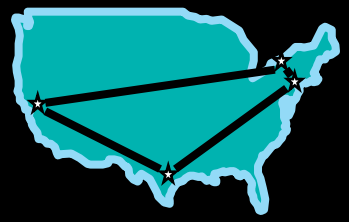
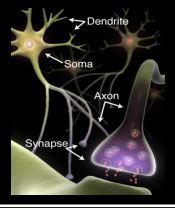
Dharmendra Modha's SyNAPSE Team and collaborators

IBM Research – Almaden
IBM Research – Austin
IBM Research – Watson
Cornell University
50+ researchers and designers



http://www.research.ibm.com/cognitive-computing/neurosynaptic-chips.shtml

The Four MICrONS Pillars

Algorithmic Framework 	Data on the Structure and Function of Cortical Microcircuits 
Computational Neural Models of Cortical Microcircuits 	Novel Machine Learning Algorithms 

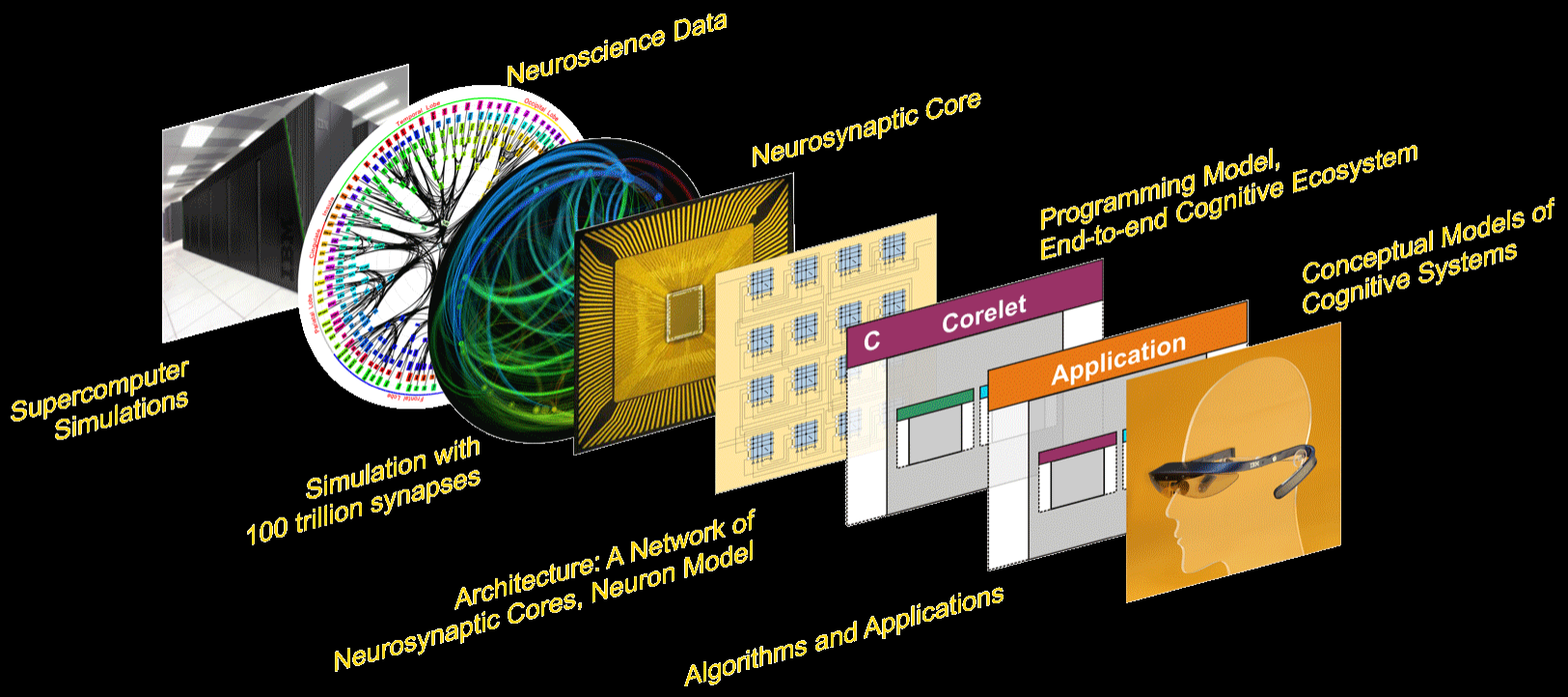
Inference and Recognition Algorithms on IBM's TrueNorth Architecture

Algorithms:
convolution networks
lateral and recurrent networks
feature extraction
spectral content estimators
liquid state machines
restricted Boltzmann machines
FSMs
hidden Markov models
looming detection
temporal pattern matching
classifiers

Applications:
speaker recognition
music composer recognition
digit recognition
sequence prediction
collision avoidance
optical flow
eye detection
saliency system
air robot path following

On-going:
Tomaso Poggio's HMAX,
Jeff Hawkins' HTM
Itamar's spatio-temporal clustering
probabilistic graphical models,
dynamic BBNs,
Eliasmith's neural eng. framework

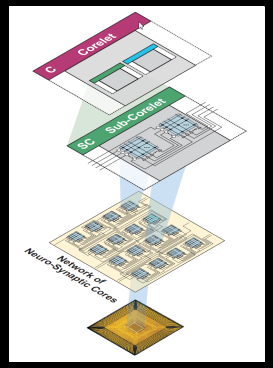
SyNAPSE Ecosystem



Corelet Programming Environment (CPE) enables:

- Specification and composition of large networks, built from various components, that concurrently perform different tasks.
- Construction of complex applications and cognitive algorithms - while being efficient for TrueNorth and effective for programmer productivity.

(Amir et al 2013)

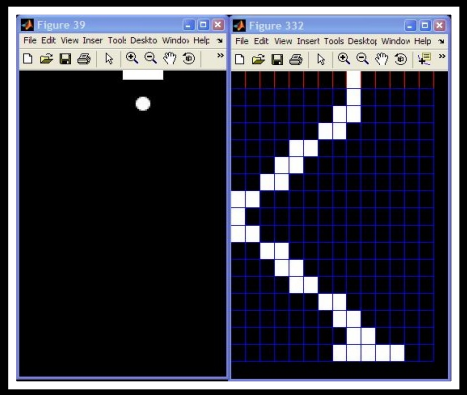


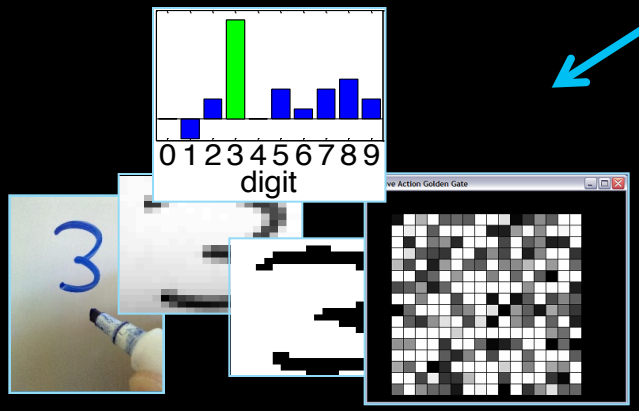
Neurosynaptic Example Applications

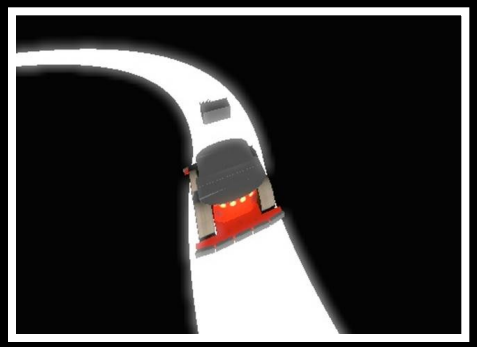
playing pong

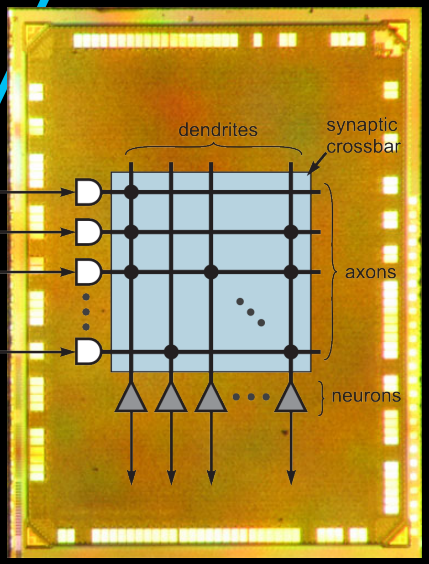
recognition tasks

driving a car

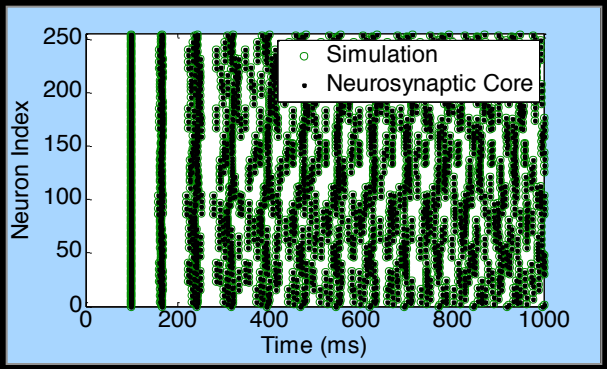








Confirm GG is 1:1 with software model
- Leak = +1
- Threshold = 100
- Synapse Strength = +1
- Synapse set p=0.2; recurrent connections



(Arthur et al 2012)

Contact Information

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Looking for neuroscience data that can be used for computational modeling.